

## SECTION 8

### SEWAGE PUMPING STATION RTU/PUMP CONTROL PANEL

- 8.1 GENERAL**
- 8.2 DRAWINGS**
- 8.3 PRE-SUBMITTAL INFORMATION**
- 8.4 GUARANTEE**
- 8.5 SCOPE**
- 8.6 CONTROL SYSTEM AND CONTROL PANEL**
- 8.7 LIFT STATION CONTROLLER/TRANSCIVER RTU I/O**
- 8.8 POWER EQUIPMENT**
- 8.9 BACKUP LEVEL CONTROL**
- 8.10 LOCAL ALARM SYSTEM**
- 8.11 SHOP DRAWINGS**
- 8.12 FIELD SUPERVISION**

## SECTION 8

### SEWAGE PUMPING STATION RTU/PUMP CONTROL PANEL

#### 8.1 GENERAL

- 8.11 It is the intention that this specification shall cover a complete Lift Station RTU/Pump Control Panel to add on to the existing Radio Telemetry SCADA System as hereinafter described and all necessary appurtenances, which might normally be considered a part of the complete electrical system for this installation. All of the automatic control equipment is to be supplied by one manufacturer. It shall be factory assembled, wired and tested , installed and covered by complete electrical drawings and instructions.
- 8.12 The control system described hereafter is a Bulletin F100/D620i FM Radio Telemetry Control SCADA System as manufactured by US FILTER/Control Systems of Vadnais Heights, MN. The naming of a manufacturer of equipment in this specification is not intended to eliminate competition or prohibit qualified manufacturers from offering equipment. Rather, the intent is to establish a standard of excellence for the material used, and to indicate a principle of operation desired. The contractor's bid shall be based on the use of US FILTER/Control Systems equipment. Unless the bidder clearly indicates in his bid that he is offering an equal product approved by the engineer via a pre-bid submittal, his bid shall be considered as providing the brand name product referenced in the specifications above.
- 8.13 It is important for all bidding contractors to note that if alternate proposals based on substituted systems are to bid, they must be prequalified by the consulting engineer fifteen (15) days in advance of the bid date. In the event a prequalified system is installed by the Contractor and does not meet the specified intent of this specification with regard to reliability, efficiency, functional capability, or other system parameters, the alternate system may be rejected by the Consultant and must be replaced with the USFILTER/Control Systems system originally specified. This option may be exercised by the Owner of the Consultant at any time during the project tenure. Project tenure is defined as beginning the date the project bids and ending on the date the system has operated satisfactorily for one year after final acceptance.
- 8.14 Signal conditioning, setpoint, control, alternation, logic function, transducer, alarm and all other control functions shall be performed by solid-state modules which shall be standard catalog items of the system manufacturer, with proven field performance.
- 8.15 At least one module of each type used in the system shall be stocked by the system manufacturer for system expansions or renewal parts purposes. The modules shall be of a compatible, integrated control family with a full range of control/protective/alternation/telemetry capabilities and associated housings, enclosure system and appurtenances to perform a variety of functions required by this project and foreseeable expansion. It is the intention of this specification to disallow non-standard, "one of a kind", experimental, unproved combinations of equipment.
- 8.16 The level transducer shall be a standard product manufactured by the control supplier in order to assure one source responsibility, ready availability, proper system interconnections and reliable, long-term operation.

## 8.2 DRAWINGS

- 8.21 Shop Drawing Submittals Shop Drawings shall be submitted for approval for all equipment herein specified. All project drawings shall be generated using AutoCAD, latest revision. The Shop Drawing Submittal shall include a Document List. An Order Specification shall be included which shall describe in detail all equipment provided. Each panel shall be provided with a job-specific wiring diagram, parts list (with all parts keyed to the wiring diagrams), enclosure door layout and enclosure dimension drawing. This requirement includes the MCC. Manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. Standard sales brochures shall only be provided to supplement technical data. Interconnection details shall be shown on the wiring diagrams for all field-mounted instrumentation. A Description of Operation shall be provided detailing the operation of the complete system, including the various control loops, system power equipment and alarm handling.
- 8.22 As-built Drawings and Instruction Manuals Provide As-built Drawings and Instruction Manuals. These manuals shall include corrected Shop Drawings. In addition, a detailed Programming and Operations Manual for the Microprocessor-based Controller/Transceiver and Control and Monitoring software package shall be included. The manual shall include all information as detailed in Paragraph F15 as well as all "as programmed" setpoints for level alarms, pump control and other parameters.

## 8.3 PRE-SUBMITTAL INFORMATION

- 8.31 The Engineer will issue an addendum describing acceptable equipment prior to the bid date. The bidder shall include all expenses necessitated by use of non-specified equipment in his bid price.
- 8.32 Presubmittal data shall include, but not be limited to, the following requirements to be submitted to the Engineer not less than 15 days prior to bid date.
1. Full description and performance data on all substitute items proposed with references for verification of performance for such equipment already in service, all data in triplicate.
  2. Detailed description of how the proposed substitute differs from that specified including but not limited to materials of construction, fabrication, operation, warranty, service, corrosion protection, power consumption, maintenance requirements, etc.
  3. Detailed discussion of why the proposed substitute is equal or superior to that specified in material of construction, fabrication, operation, warranty, service, corrosion protection, power consumption, maintenance requirements, etc.
  4. Tracings and four copies of revised prints reflecting in detail any and all changes in arrangements for materials, equipment, piping, fabrication, erection, maintenance, power supply, etc.
  5. Provide a Programming and Operations Manual for the Microprocessor-based Controller/Transceiver (MCT). The manual shall include the following information as a minimum:
    - a. How to view and change between the various displays

- b. Alarm displays and a list of alarms handled
- c. Alarm handling (ISA sequence used, etc.)
- d. Status displays and a list of status' handled
- e. Status handling
- f. Analog control setpoint adjustment and displays
- g. Analog alarm setpoint adjustment and displays
- h. Access code usage
- i. An example of programming values
- j. Use of the real-time calendar/clock, including changing the time and date

6. Provide a Programming and Operations Manual for the Microcomputer-based Software system. The manual shall include the following information as a minimum:

- a. How to view and change between the various displays
- b. A list of alarms handled
- c. Alarm handling (ISA sequence used, etc.)
- d. A list of status' handled
- e. A list of analog signals handled
- f. A list of all graphic displays proposed
- g. What standard operating system is used

7. The intent of the specification is that a standard system be provided, with standard documentation. A custom written Description of Operation is not acceptable.

8. Name and telephone number of person(s) to contact to answer questions or supply additional information.

9. Failure to name an approved manufacturer in each space provided in the proposal, will constitute grounds for declaring the bid irregular, or if the Owner chooses, will give the prerogative of equipment selection solely to the Owner. If more than one manufacturer is named in any space it will declare that the Bidder has no preference and will give the prerogative of equipment selection solely to the Owner.

#### **8.4 GUARANTEE**

All equipment shall be guaranteed against defects in material and workmanship for a period of one year from date of Owner's final inspection and acceptance to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

#### **8.5 SCOPE**

The control and telemetry system shall consist of the following:

Item A – Provide and Install the Lift Station Transceiver; RTU and Pump Control Panel

Item B - Modifications to existing CTU/Computer MMI package

- A. Item A shall monitor and transmit the Lift Station status to the existing CTU Controller/Transceiver for monitoring. *Reference the Input/Output Schedule later in these specifications for specific transmitted data.* Item A shall also include the

required motor starters and breakers, etc., for complete control of the pumps along with a main breaker, emergency breaker and generator receptacle.

- B. Item B shall provide monitoring of Item A by updating the existing SCADA system including graphics.

## **8.6 CONTROL SYSTEM AND CONTROL PANEL**

- A. **INTENT OF SPECIFICATION.** The Contractor shall furnish, install "Control Systems" equipment and place into operation a Lift Station Control/Radio Telemetry SCADA System designed to automatically operate the pumps as described herein. The pumps will operate in a specified sequence, in response to variations in the liquid level.
- B. **WIRING.** All wiring shall have not less than 600 volt insulation and all power wiring and bus shall be in complete conformity with the National Electric Code and state and local and NEMA Electrical Standards. Control wiring shall be color coded. All job connections required to conveniently replace control components shall be made at approved type terminal blocks with engraved bakelite marker strips or similar approved means.
- C. **UL LABEL.** The equipment shall be constructed in compliance with Underwriter's Laboratories Industrial Control Panels listing and following-up service, utilizing U.L. listed and recognized components where applicable. The control panels shall be built in a Underwriter's Laboratory listed manufacturing facility and labeled to that effect.
- D. **INCOMING SERVICE**
  - 1. The incoming service for the Control Panel shall be either 480 volt, 3 phase, 3 wire or (240 volt, 3 phase, 4 wire) 60 Hertz. This shall be confirmed by the Contractor prior to bid. All metering shall be done ahead of the main disconnect and control panel. The meter shall be installed by the Contractor in accordance with local power company requirements.
  - 2. A lightning arrestor shall be supplied in the panel and shall be connected to each line of the incoming side of the power input terminals. The arrestor shall protect the control against damage as the result of transient voltage surges caused by lightning interference, switching loads and power line interferences.
  - 3. The control panel shall be supplied with a properly sized control power circuit breaker, starters and breakers, etc. as describe later.
  - 4. In addition to the lightning arrestor noted in two above, an APT TE XF series surge suppressor shall be installed in the RTU/PCP.
- E. **ENCLOSURE.**
  - 1. The described communications equipment at Unit A shall be housed in a NEMA 3R gasketed on top and sides, wall mounted enclosure properly sized to accommodate all control and data communications elements and the required motor starters, breakers, transformer, etc. (approximately 48" high, 36" wide, 12" deep). The enclosure shall be constructed of stainless steel with a stainless steel hinged door and closures. The enclosures shall include a removable inner panel painted white enamel. The enclosure shall

also be furnished with a top mounted sun shield and three point latching mechanism with padlockable handle.

2. The level indicator/controller, status and alarm lights, running time meters and H-O-A switches shall be mounted on the inner door of the enclosure.
3. All major components and sub-assemblies shall be identified as to function with laminated, engraved bakelite nameplates, or similar approved means.

The following described equipment shall be furnished for each of the control systems required and matched to the specific pumping station equipment:

#### F. PUMP PROGRAMMABLE CONTROLLER/MONITORING SYSTEM (MCT)

1. A Microprocessor-based Controller/Transceiver (MCT) shall be mounted on the control panel inner door. The controller shall be provided with a Class II UL listed transformer/power supply. Voltage regulation and battery charging circuitry shall be on-board.
2. The controller shall be a standard, catalogued product of a water and wastewater pumping automation equipment manufacturer regularly engaged in the design and manufacture of such equipment. The controller shall be specifically designed for water and wastewater pumping automation utilizing standard hardware and software. "One of a kind" systems using custom software with a generic programmable controller will not be acceptable.
3. The controller shall be capable of monitoring analog and digital information. Analog variable setpoints shall be provided for Wetwell levels. All levels shall be presented in engineering units. Setpoints based on the Wetwell level shall be provided for the following:
  - a. High alarm On/Off
  - b. Lead Pump On/Off
  - c. Lag 1 Pump On/Off
  - d. Low alarm On/Off
4. The controller shall be capable of accepting three (3) analog (1-5 VDC or 4-20 mADC) and twelve (12) digital inputs in its base form. The controller shall provide two (2) analog and ten (10) digital outputs in its base form. The controller shall incorporate 12-bit analog to digital and digital to analog conversion. Additional telemetered analog and digital signal monitoring capability shall be built-in. Additional local analog inputs shall be provided in increments of four (4). Additional local digital inputs or outputs shall be provided in increments of eight (8). Additional analog outputs shall be provided individually.
5. The operating program shall be resident in ROM and include full-scale ranging and pump-up/down determination. The controller shall be arranged to operate up to eight (8) pumps plus high and low (analog) alarms in it's base form. The ON and OFF adjustments of each pump and alarm setpoint shall be full-range adjustable through use of an authorized operator access code and a keypad. The controller display shall show the operation of each control stage. Review of adjustments shall be possible by the operator

without use of the access code.

6. Input signal conditioning shall provide keypad-selectable averaging of the input signal with one reading taken every second and from one to thirty readings being selectable with the controller displaying and providing control based on a moving average of the selected number of samples.
7. The controller shall include keypad adjustable on-delay timing logic to provide staggered pump starting following a power failure condition. Keypad adjustable off delay timing for each pump control stage shall provide smooth transition between control stages.
8. In addition to the pump and alarm control capability, the controller shall provide alarm annunciation. The controller shall, upon the occurrence of an alarm, sound an audible device and flash the alpha-numeric display. The display will indicate the alarm description, complete with the time and date of the alarm occurrence. An acknowledge pushbutton shall be provided to allow silencing of the audible device while the digital display will continue to show the alarm function, complete with time and date information, until the condition has cleared.
9. The controller shall include totalization of Running Times for each pump based on Pump Run inputs.
10. The controller shall include C800 Volumetric flow calculation with stored data on pump running and pump cycles. Also to include stored data on totalized pump flow per pump and station total.
11. The controller shall include Pump Fail Timers to generate a Pump Fail alarm if a Pump is called for and the Run input is not received within the programmed time. The controller shall then perform Pump Fail Replace Logic by calling for another pump without waiting for the level to rise to the next stage.
12. Available capabilities shall include:
  - a. Multiple analog inputs (both local and telemetered) with alarm and control setpoint capability for each
  - b. Multiple pump alternators (for varying sized pumps)
  - c. Varying alternation and sequencing schemes (rotary, first-on, first-off, manual, fixed)
  - d. Flow totalization
  - e. Time-of-day control
  - f. Delays (on- and off-delay)
  - g. Load cycling/shedding with automatic or manual activation
  - h. PID (proportional-integral (reset)-derivative (rate)) control
  - i. Analog output ramp (variable speed pump/valve positioning) control
  - j. Automatic pump replacement upon a pump failure input (pump failed/replaced)
  - k. Analog input adder-subtractor-multiply-divide
  - l. Automatic highest/lowest analog signal selector (for basis of control)
  - m. Pump run time/time of day/day of week/external digital input alternator advancement

13. The controller's display shall operate in a manual scrolling menu mode with the various displays shown in sequence as selected by the keypad's up/down arrow keys. The display shall indicate the specific function entered on the keypad to confirm that selection of a particular output or other function from the keypad during adjustment or review routines. When operating a key of the controller the audible alarm shall chirp briefly to confirm that the selected key has operated.
14. The controller shall be housed in a flush-mounted, environmentally-protected assembly and mounted on the inner door of the control panel. All connections shall be made via plug-in terminal blocks.
15. The controller shall employ an operator interface having a thirty-two character alphanumeric backlite LCD display with character height not less than .3" and with a sixteen position keypad operating in menu mode.
16. A watchdog function shall be provided which observes meaningful microprocessor activity. In the unlikely event of microprocessor stoppage the watchdog shall reset the processor. In addition, it shall transfer Form C contacts provided to job connection terminals.
17. The controller shall have two (2) RS-232C serial communications ports. One used to connect to the Radio Modem and the second for future use.
18. It is the intention of this specification that a standard controller/transceiver be provided, with all of the control and communications features described as a fully-integrated assembly. The controller shall be a USFILTER/Control Systems Bulletin D620i.

#### G. ANALOG ISOLATION

1. The D620i shall be provided with analog input isolation modules with loop power capability for interface to all field mounted analog transmitters to include: Wetwell level sensors. The unit shall provide a minimum of 750 Volts isolation between the voltage input of the D620i and the transducer and include three stage surge suppression for reliable operations during possible electrical transients. The isolation amplifier shall be powered by 12 VDC to permit operation from batteries during incoming power interruptions.
2. The D620i shall be provided with analog output isolation module for interface with existing remote equipment. The analog output isolator shall provide 750 Volts isolation between the voltage output of the D620i and the current output to the remote equipment. The isolation amplifier shall be powered by 12 VDC to permit operation from batteries during incoming power interruptions.

#### H. COMMUNICATIONS MODEM

1. A modem shall be provided with each previously specified MCT for communications. The modem shall communicate at not less than 1200 baud. All data and control signals between the modem and MTU shall be pin compatible at RS-232 levels. The modem shall have an integral transistor driver for radio key, activated by the Transmit Enable (TXE) input.



2. The modem shall have on-board LEDs for indication of transmit data, receive data, transmit enable and carrier detect. A Transmit Level potentiometer shall provide adjustment of the signal from -9 to 0 dBm into 600 ohms. Twenty-five modes of operation shall be possible via a multi-position Mode Select switch. The modem shall be a USFILTER/Control Systems Model CMM202.

## I. RADIO COMMUNICATIONS EQUIPMENT

### 1. Radio Transceivers

Transceivers shall be 100% solid state units operating in the UHF or VHF range (MATCH EXISTING FREQUENCY). All radio connections shall be via plug-in connectors. This requirement applies to the coaxial cable feed line, radio power and data connections. The FM transceivers shall meet the following as a minimum:

#### Transmitter:

- a. Selectable 1, 2 or 5 watt power output as required per each location and as allowed by the system FCC license
- b. Spurious and harmonic emissions: -60dB
- c. Frequency stability: +/-0.0005% over a temperature range of -30 to +60 degrees C
- d. Transmit rise time: 50mS
- e. Audio distortion: less than 6%
- f. FM hum and noise: -50 dB
- g. Audio frequency response: +1/-3 dB per octave pre-emphasis from 300- 3000Hz
- h. Modulation: 16F3 +/-5KHz

#### Receiver:

- a. Sensitivity; 12 dB SINAD: 0.35 microvolts; 20 dB Quieting: 0.50 microvolts
- b. Selectivity: -65dB at +/- 25KHz
- c. Spurious and image rejection: -60dB
- d. Intermodulation rejection: -60dB
- e. Audio power output: 500 milliwatts
- f. Frequency stability: +/-0.0005% over a temperature range of -30 to +60 degrees C

The transceivers shall comply with FCC parts: CP-15, 21, 74, 90, 95; CS-15, 22, 74, 90, 95

### 2. Antenna Systems

Furnish and install an antenna for each transceiver. Mount antennas on self-supporting tri pod towers as required for reliable signal transmission. All antennas and supporting structures shall be designed to withstand a 120 Mph wind.

Remote antennas shall be a 5-element Yagi array with a gain of at least 9 db. The central antenna shall be an omnidirectional type with a minimum gain of 3 dB.

Each radio telemetry unit shall be provided with a bulkhead-type antenna/cable lightning arrestor, one hundred feet of RG-8/U coaxial cable and all required connectors.

### 3. Licensing

The system supplier shall be responsible for obtaining the FCC station and operating licenses for the owner. This shall include performing a path study based on data provided to the system supplier by the owner/engineer. This information shall include:

- a. Area topographic maps
- b. Site names/locations and addresses
- c. Site ground and building/pole elevations
- d. Latitude and Longitude for each site
- e. Approximate path length

The system supplier shall be responsible for the following:

- a. Obtain FCC approval for system operation
- b. Prepare all materials required by the FCC
- c. Obtain all license application forms, write in all required information and forward to the owner for signature(s)
- d. Provide all information required by the area frequency coordinator

### J. POWER SUPPLY

A power supply and solid gel battery shall be furnished to power the microprocessor based controller, transducer, radio transceiver, modems, etc. The battery shall be sized to allow for continuous operation of the communications equipment for six hours after the occurrence of the power failure condition.

## 8.7 LIFT STATION CONTROLLER/TRANSCIVER RTU I/O

Description	Type	Source/Destination
System Pressure	AI	(Future Pressure signal)
Wet Well Level	AI	A1000i transducer in wet well
Pump 1 Call	DO	Pump 1 is called to run
Pump 2 Call	DO	Pump 2 is called to run
Pump 1 Run	DI	MS Aux
Pump 2 Run	DI	MS Aux
High Level	DI	Field contact
Low Level	DI	Field contact
Pump 1 Auto	DI	Pump 1 is in auto
Pump 2 Auto	DI	Pump 2 is in auto
Power Failure	-	Generated by MCT

Pump 1 Fail	-	Generated by MCT
Pump 2 Fail	-	Generated by MCT

Note: Type designations are as follows:

AI = analog input

DI = discrete input

AO = analog output

DO = discrete output

## 8.8 POWER EQUIPMENT

### A. MOTOR STARTERS & BREAKERS

1. NEMA rated starters shall be furnished for each of the pump motors. They shall be sized per the NEC. The motor starters shall be Square D Class 8536 and shall be furnished with an ambient compensated overload relay. Alternate motor starter manufacturers will not be considered. Each starter shall be furnished with an inner door mounted overload reset and the required heater elements sized for proper protection of the motor.
2. A molded case motor circuit protector (MCP) shall be furnished for each motor circuit. The MCP shall have a magnetic trip only, providing short circuit protection, and shall be coordinated with the motor starter for proper motor protection.
3. A main breaker and an emergency breaker shall be furnished to service as a manual transfer switch and main breaker protection. The two breakers shall be mechanically interlocked preventing simultaneous closure of both devices. The main breaker shall be connected to the utility power accepting power from the remote service entrance disconnect. The emergency breaker shall be wired to a generator receptacle mounted on the side of the enclosure. The receptacle shall meet City standards. The control manufacture shall coordinate with the City to insure the receptacle will properly mate with the City's generator plug.

### B. PHASE FAILURE RELAY

A phase-loss/unbalance/reversal and under-voltage protection assembly with adjustable nominal voltage setting shall be provided with three extractor type line voltage fuses. This device shall automatically lockout pump operation if all phases drop below 90% or if one phase drops below 80-83% nominal voltage. This device shall have a nominal 1/2 second dropout delay. The phase failure relay shall be

### C. SELECTOR SWITCHES & LIGHTS

An Operator's door mounted, 1-3/16" diameter, "hand-off-auto" 3 position, rotary, oil-tight, heavy duty type selector switch shall be furnished for each pump. Each switch shall have an extra contact for input to the telemetry.

An operator's door mounted, 1" diameter, oil tight pilot light with bulb shall be provided for each of the following conditions:

- Pump running (2)
- Pump overtemp (2)
- Pump seal leakage (2)

#### D. PUMP RUNNING TIME METERS

An operator's door mounted, 120 VAC powered running time meter measuring hours and tenths of hours of operation up to 99999.9 hours shall be furnished for each pump motor indicated.

#### E. CONDENSATION PROTECTIVE HEATER

A 100 watt, 120 VAC condensation protective heater and high temperature cutout thermostick shall be supplied in the control panel. The heater's surface area for heat dissipation shall be large enough to prevent a skin burn (if an operator's hand should inadvertently come in contact with the unit when energized).

#### F. CONVENIENCE RECEPTACLE

A GFI convenience receptacle shall be furnished and mounted on the inner door of the pump control panel. The control power transformer inside the control panel shall provide at least 1500 watts of power for the receptacle in addition to the power required for the control logic and heater.

#### G. PUMP OVERTEMPERATURE PROTECTION

Over-temperature protection shall be provided in the control panel to operate in conjunction with the over-temperature switch in each pump motor. The control shall provide pump lockout of operation upon occurrence of high temperature. The circuitry shall also include a yellow failure indicating light and reset pushbutton on the inner panel for each pump for alarm indication and manual reset capability.

#### H. PUMP SEAL FAILURE ALARM

A seal leak relay shall be furnished for each pump to sense a seal leakage condition. The control manufacture shall coordinate the relay furnished with the pump manufacture to insure compatibility. A door mounted pilot light and seal leakage sensor shall be provided to indicate a pump seal failure alarm condition of each sewage pump.

### 8.9 BACKUP LEVEL CONTROL

An independent high and low level alarm and redundant pump control capability with features as hereinafter listed shall be provided in addition to the specified primary control system. It shall be powered by a 120 vac circuit breaker.

The independent alarm/control panel equipment shall be designed to UL508 Industrial Control Panel standards and shall incorporate 120 VAC input power transient protection, a fused primary and a DC power supply with limited 12 VDC to power the level sensing float circuits. The front face of the controller accessible through the operator's door and shall incorporate four red LED indicators; a "control hold" LED, a redundant control "turn on" LED, a high level alarm/monitor LED, a "control contacts" energized LED and a pump "off

delay” time control adjustment with a 0-5 minute range.

The transducer level control shall operate in conjunction with five direct-acting float switches. The “pump required” and high level alarm float switch shall be mounted in the wet well at a higher elevation than the wetwell level setpoint elevation of the primary control and high alarm: The float switches shall be mounted in the wet pit in accordance with the manufacturers instructions or as shown on the plans.

Upon the occurrence of a full wetwell condition sensed by the “pump required” floats actuating, the control system shall activate and operate the pumps in redundant float mode. These control circuits shall be wired in parallel with the primary control system two-wire control circuits to provide a redundant capability.

A “pump off” float switch (mounted in the wetwell below the “pump off” setpoint/elevation of the primary control system ) shall be wired to prevent operation of the pumps from either the primary control or the backup control.

The redundant control/alarm capability shall be completely integrated in the specified control panel and system as described and in accordance with all applicable codes and job requirements.

Each liquid level sensing float switch shall have a 4½” diameter molded polypropylene body, potted switch/cable connections and fine-stranded AWG #18 cable with heavy-duty synthetic rubber jacket in lengths as required to run unspliced to the (control panel) (junction box).

The Contractor shall furnish, install and wire the float switches as shown on the drawings. Each float switch shall be internally weighted and be individually suspended in the wet well. The float switch cables shall be suspended from a cable rack mounted to the top slab of the wet well.

#### **8.10 LOCAL ALARM SYSTEM**

A audible alarm horn weatherproof alarm silence pushbutton (mounted on the side of the enclosure) shall be provided. The alarm horn shall be weatherproof, operating on 12 VDC producing 87 dB minimum at 10 ft. The horn shall be surface mounted with weatherproof backbox on the side of the pump control cabinet.

The alarm light shall be a weatherproof strobe operating on 12 VDC, producing a 500,000 candlepower flash through a high-impact red lexan lens operating at 60 to 90 flashes per minute. The light shall be surface mounted on the top of the pump station control cabinet, through a cutout in the sun shield and be very noticeable both night and day.

The horn and strobe light shall be energized on a high level alarm condition.

#### **8.11 SHOP DRAWINGS.**

A complete set of drawings shall be supplied to insure successful installation and operation of the control system. The shop drawings shall consist of all of the following:

- A. Sufficient detail to evaluate compliance with these specifications.
- B. A detailed component list including manufacturer and catalog number.
- C. A custom wiring diagram for this specific application to facility and insure accurate field

connections to the control panel by electrical installation personnel.

D. A description of operation for the control system.

E. An enclosure dimension print.

#### **8.12 FIELD SUPERVISION**

The services of a factory trained, qualified representative shall be provided to inspect the completed installation, make all adjustments necessary to place the system in trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment.

(Reserved)